XVI. *Further notes on* Dyscritina, Westw. By E. Ernest Green, F.E.S. *With an Appendix on the species of* Dyscritina *reared by Mr. Green.* By Malcolm Burr, F.Z.S., F.E.S.

[Read March 16th, 1898.]

Plates XVIII. and XIX.

On March 18th, 1896, I had the honour of reading at a meeting of this Society, a few notes on *Dyscritina longisetosa*, Westw., in which I drew attention to the similarity of structure in this genus to that of the Forficulidæ. During the discussion that followed, it was suggested by several members that Westwood's insect was immature, and that the adult form would be winged.

Upon my return to Ceylon in January, 1897, I set myself the task of tracing out the life-history of this interesting insect. I am now able to report that I have been so far successful that, with the exception of the actual change from the egg to the young larva, I have followed the transformations of *Dyscritina* to its final stage, and witnessed the pairing of the adult insects and the subsequent oviposition.

I may here say that the above-mentioned surmises have proved to be correct, and that the adult *Dyscritina* is provided with ample wings and caudal forceps in both sexes, the general appearance of the imago being that of a typical earwig. One character that distinguishes *Dyscritina* from most other Forficulidæ is the presence in the imago of a well-developed pad (*pulvillus*) between the claws (Fig. 14), which enables the insect to run with ease over a glass surface.

Examples of the insect are not uncommon in this district (Pundaluoya). I have as yet had no opportunity of searching for it in other parts of Ceylon.

The usual habitat of the larva is beneath loose stones on the surface of the ground. I have occasionally found specimens under moss upon rocks, and under loose bark of trees. In fact it frequents much the same situations as do the common earwigs. One curious difference of

habit is noticeable. On lifting a stone, a *Dyscritina*, when present, will usually be found back downwards, clinging to the stone itself; while other Forficulids that I have found in a similar habitat are generally seen resting on the ground beneath the stone.

*Dyscritina* is extremely agile, and a very difficult subject to secure. I do not recollect having met with any other insect that can run so rapidly. It simply darts across the surface of the stone and either conceals itself in some crevice on the other side, or drops to the ground and is lost beneath any rubbish that may be lying about.

The adult insect flies at night. I have taken several examples in my rooms, attracted by the lamp.

For purposes of study I find it advisable to keep the living insects confined in a somewhat small space. If allowed more ample room they conceal themselves too easily for convenience of observation. A small glass-topped cardboard box forms a convenient breeding cage, and a piece of moss-covered bark will provide sufficient shelter.

I have been unable to determine the natural food of *Dyscritina;* but it probably consists of small soft-bodied insects. In captivity both larva and imago feed sparingly upon the dead bodies of small spiders and of flies and other minute insects, showing a preference, however, for some species. They do not appear to care for lepidoptera. The common mosquito is not relished, though if *Dyscritina* is very hungry it will devour the abdomen of that insect. Bread, raw meat, petals of flowers, fruit, minute fungi, were offered, but were all refused. When food is offered to an adult *Dyscritina* it usually goes through a curious performance to test its suitability. It takes up its position to one side of and slightly in advance of the object; then bending its abdomen round to one side, it gives it a sharp nip with its forceps and retires quickly to note results. If the proffered object does not resent this treatment, it is then considered safe and fit for food: but if the victim makes any movement, *Dyscritina* immediately retires beneath its shelter.

The insects remain under cover during the day, but become very active and restless at night. When disturbed they run about with the extremity of the abdomen erected and the long caudal appendages inclined forwards.

Amongst the numerous examples obtained in this

locality there appear to be two distinct species. Not being properly conversant with the important points of the Forficulidæ, I will not myself attempt a formal description, but content myself with noting some general characters by which the two species may be distinguished. They may be separated roughly by the structure and proportionate length of the caudal appendages in the larval stages.

In the typical form, *D. longisetosa*, the cerci are considerably longer than the body of the insect, cylindrical, multiarticulate, with many fine longish backwardly-directed hairs amongst the shorter pubescence (Figs. 4, 16).

In the new species these appendages are always shorter than the body of the insect, with comparatively few joints, tapering and with a few stout forwardly-directed spines amongst the shorter pubescence (Figs. 2, 15).

The general coloration of the two species is also different. In its larval stage *D. longisetosa* may be readily distinguished by its paler tints, the abdomen being straw-colour with brown transverse bands (Fig. 4). The larva of the new species (Fig. 2) is of a more uniform blackish-brown colour, and the femora are more distinctly banded. In both species the hinder angles of the prothorax are ornamented with well defined straw-coloured patches (Fig. 2, 4).

The imago of *D. longisetosa* varies in colour from castaneous to bright fulvous. In the darker form the prothorax bears a conspicuous blackish curved fascia on each side (Fig. 5). The paler variety usually has a diffuse brownish fascia upon the middle of the elytra.

In the new species the general tint is blackish brown. The female (Fig. 3) is more suffused with castaneous, the elytra are more conspicuously reddish.

The male insect is distinguished by the greater number of abdominal segments (Fig. 6).

On Oct. 27, 1897, a pair of this new species, reared up in captivity, were found *in coitu*. The abdomen of the male was twisted round and the extremity was closely applied to the undersurface of the pygidium of the female.

The first eggs were deposited on November 4, and others were added at intervals during the following week, until a total of twenty-five had been laid. The eggs were

scattered singly over the exposed surface of the moss-covered bark which had been provided as a shelter for the insect, adhering slightly to their support. Towards the end of the egg-laying period a few were deposited in irregular clusters and unattached to the moss. The parent remained constantly near her eggs, visiting each one in turn, and mouthing them in a peculiar manner as if to keep them clean.

The egg is regularly elliptical; pale pinkish yellow; shining; long, 0·80 mm.; broad, 0·50 mm.

In spite of the attentions of the parent the eggs gradually shrivelled and dried up, and were eventually devoured. The female parent lived on till January 18, 1898, feeding upon small insects and drinking water greedily. This specimen was captured early in October and was then in the penultimate stage. It lived in captivity for 3½ months.

The following notes upon the development of *Dyscritina* apply to both species of the insect.

In ecdysis the skin splits along the median dorsal line of the thorax, and is shed in one complete piece, including the covering of the delicate caudal appendages. I have been unable to satisfy myself as to the total number of ecdyses undergone, the examples under observation being from a quarter to half grown at the time of capture. I have, however, observed four successive moults, the last revealing the adult insect. Each stage occupies about ten days.

With each moult, instead of a diminution in the number of joints of the caudal appendages there is a distinct progressive increase in the length of the cerci until shortly before the final ecdysis, when the appendages are abruptly curtailed, leaving nothing but the long basal joint on each side (Fig. 1). The number of joints is variable and seldom exactly the same in both cerci of any individual. The following series of measurements will demonstrate this development of the caudal appendages.

DYSCRITINA LONGISETOSA.

No. 1. *Body* 2·5 mm. long. *Cerci* of same length with 14 joints. *Antennæ* with seven joints.

No. 2. *Body* 3 mm. long. *Cerci* 6 mm., with 27 joints, many with incomplete divisions where fresh joints are forming. *Antennæ* with 10 joints.

No. 3. *Body* 4·5 mm. long. *Cerci* 10 mm., with 43 joints. *Antennæ* with 8 joints on left and 9 on right side.

No. 4. *Body* 6·5 mm. long. *Cerci* incomplete, apparently injured (within them the cerci of the next stage are plainly visible and it is noticeable that the joints of the two sets do not correspond). *Antennæ*, left with 14, right with 12 joints.

No. 5. *Body* 7·75 mm. long. *Cerci* 13·5 mm., with 45 joints.

No. 6. The penultimate stage.—*Body* 9 mm. long. *Cerci* 1 mm. *Antennæ* with 14 joints.

The length of the adult insect varies from 11·50 to 16 mm. of which the forceps occupy from 1 to 1·25 mm.

In the larva of the new species there is a corresponding increase in the number of joints of the cerci during growth; though in this case it is more gradual and less noticeable as the total number of joints is much smaller, the fully grown larva having only from 18 to 20 joints in these appendages. Their total length is only about three quarters that of the body of the insect.

As stated above, in the penultimate stage the cerci are abruptly curtailed to a single joint. These basal joints retain their previous character, and bear no resemblance to the forceps of the perfect insect. They are quite straight, with irregularly truncate extremities, looking as if the subsequent joints had been broken or bitten off. And I believe that such is really the case. No cast skin has been observed to accompany this change, and in one instance the insect lost the appendage on one side twenty-four hours before the opposite one disappeared. The superfluous parts are probably eaten off by the insect itself. Upon examination of the abbreviated caudal appendages by transmitted light, the future forceps of the adult insect can be plainly seen within them (Fig. 11).

From the above facts it would appear probable that the single jointed cercus (forceps) of the larval *Forficulidæ* is not formed by a fusion of smaller joints, but corresponds with the long basal joints of the larval appendages of *Dyscritina*.

Towards the end of the larval period the notal plates of the metathorax are distinctly sculptured with a radiating pattern, resembling in miniature a Forficulid wing (Figs. 2, 4).

The glandular folds of the (3rd and 4th ?) dorsal plates of the abdomen commence to appear when the larva is about half grown. Fig. 10 is taken from an example with a body length of 4·50 mm.

Another character is noticeable in all stages—from the young larva to the adult insect. Towards the undersurface of each antennal joint can be distinguished an oval glandular (?) body (Figs. 12, 13), indicated on the surface by a shallow depression and a minute pore. I suppose these to be sense organs of some kind. Can they be of the nature of auditory organs ?

Upon the terminal joint of each of the palpi is a minute tactile organ consisting of a small fleshy tubercle bearing a number of minute points at its extremity (Fig. 7).

Throughout the larval period the feet are destitute of any pad between the claws, and the second tarsal joint is minute and fused with the first. In the adult insect the three tarsal joints become distinct, and there is a conspicuous cup-shaped pulvillus between the claws of each foot (Fig. 14).

The coriaceous tips of the folded wings of the imago project to a distance equal to about half the length of the elytra. The wing itself is ample (Fig. 6) and longer than the body of the insect. The membranous area is not entirely concealed when the wing is closed, several short folds appearing outside the coriaceous part.

The number of antennal joints in the imago is variable. One example shows 16 joints on one side and 15 on the other. Another has 13 and 16 respectively. A third example has 16 and 17; a fourth carries 15 joints only. I am inclined to consider 16 as the normal number.

I was able to observe one imago shortly after its emergence. All the parts of the insect were soft and colourless; but the wings were accurately folded in their proper position.

In the penultimate stage the femora of the first pair of legs are broad and are armed on the inner edge with a row of spines (Fig. 1) which gives them a distinctly raptorial appearance: but I have never seen them used either to catch or hold their prey. On the other hand I have watched one of these insects feeding upon and dragging about a fly without using its forelimbs for any other purpose than locomotion.

From the above general particulars the following

characters may perhaps be selected as distinctive of the genus *Dyscritina*.

Larva with many-jointed caudal appendages.

Adult with single jointed appendages in the form of forceps. Wings as in *Forficula*. Feet with pulvillus between claws. Number of antennal joints variable (normally 16 ?).

A glandular pore on each antennal joint in all stages of the insect.

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## ON THE SPECIES OF *DYSCRITINA* REARED BY MR. GREEN.

By Malcolm Burr, F.Z.S., F.E.S.

The great interest and importance of Mr. E. E. Green's paper is twofold. First, it settles definitely the vexed question of the affinities of *Dyscritina longisetosa*, Westw., and to a great extent elucidates the economy of earwigs, about which little has been known, especially with regard to tropical species. Secondly, the facts disclosed throw much light on a more general question, the origin of the Forficulidæ and their phylogenetic relationship to other insects, particularly among the Orthoptera.

An examination of the imagos which Mr. Green has bred from the *Dyscritina* form at once shows that they are to be referred to the genus *Diplatys*, Serv., to which *Cylindrogaster*, Stål, is nearly allied.

These two genera are separated by Kirby in his synoptical table by the presence on the third and fourth abdominal segments in *Diplatys* of pliciform tubercles, which are absent from *Cylindrogaster*. Both genera are represented in the tropical part of the New World as well as in Africa and Asia.

The surprising point shown by Mr. Green's investigations lies not so much in fact that the mysterious larva has developed into an earwig, for that was to a certain extent foretold by most entomologists who examined the immature specimens, but rather in the manner in which the caudal setæ develop into forceps.

That the forceps of earwigs are the homologues of the cerci of true Orthoptera is now obvious, but their manner of development, in the species before us at least, is

remarkable. I have seen immature specimens of allied genera in various stages of growth, but know of no case which presents an analogous development.

There still remain two insufficiently described creatures, at present assigned to the Forficulidæ, whose true position is doubtful but may be determined in time, as has been that of *Dyscritina longisctosa*. One of these is *Condylopalama agilis*, Sund., taken at Stockholm in timber imported from Brazil, which Mr. Kirby suggests may be *Iapyx*. The other doubtful species is *Typhlolabia larva* (Phil.), which possibly is not an earwig.

It is not yet clear to what group earwigs are most nearly allied; but it seems to me that earwigs and cockroaches are offshoots of a common stock. Some exotic cockroaches present an arrangment of the wings which is analogous with the folding of the wings of earwigs, and the development and general habits of the two groups are almost identical. A wingless earwig with jointed cerci would resemble a small wingless cockroach to a very marked extent. It is not meant to advance this theory as a definite view but rather to throw it out as a suggestion.

It was altogether unexpected that two species should be derived from the old *Dyscritina longisctosa*. Early last summer Mr. Green kindly sent me, among a lot of earwigs, an adult *D. longisctosa*; but at that time neither of us suspected that it was the imago of this curious larva, and I then regarded it as a new species of *Cylindrogaster*, Stål. As Mr. Green's two species are to be referred to the genus *Diplatys*, Serv., the first will be *Diplatys longisctosa* (Westw.); the other I regard as identical with *Diplatys nigriceps* (Kirby) from which it differs only in minor details of coloration. *D. nigriceps* (Kirby) is already known from Hong-Kong and Bombay, but *D. longisctosa*, so far as I know, has never been taken outside Ceylon.

As the latter species has not been described in the imago stage, I append a description, and to make things complete add a further description of *D. nigriceps* (Kirby).

*Diplatys longisctosa* (Westw.).

Larva. *Dyscritina longisetosa*, Westwood, Trans. Ent. Soc. Lond., 1881, p. 601, pl. xxii, fig. 1; Green, *op. cit.*, 1896, p. 229.

Colore testacea. Caput pronoto latius: pronotum subquadratum margine postico rotundato. Elytra et alae perfecte explicatae, longæ,

illa apice oblique rotundata, hae valde prominentes. Pedes testacei. Abdominis segmenta 3 et 4 tuberculis pliciformibus instructa ; segmentum ultimum magnum ; forcipum crura brevia, recta, conica.

Long. corporis 10·5–14·75 millim.; long. forcipum 1–1·25 millim.

Head flattened, reddish, slightly broader than the pronotum ; antennae testaceous ; eyes black ; mouth parts testaceous. Pronotum reddish, squared, the hinder margin rounded, the disc somewhat raised anteriorly, flattened posteriorly. Elytra long and broad, pale testaceous, the disc darker ; broader near the base, considerably narrower at the apex, where they are obliquely rounded ; scutellum visible at the base of the elytra, very small. Wings ample, projecting well beyond the elytra, the coriaceous portion testaceous on inner margin, darker on outer margin. Legs uniform testaceous. Abdomen cylindrical, reddish, basal half of the segments paler ; tubercles of the 3rd and 4th segments indistinct ; apical segment large, dark reddish, with a very faint median longitudinal sulcus, the posterior border produced into a small tubercle at each angle. Branches of the forceps stout, straight, short and conical, not quite contiguous, furnished each at the base on the upper side with a small sensory (?) foramen.

The hinder part of the head, the pronotum, the basal and apical parts of the elytra, the wings, femora and tibiae clothed with a few long bristles ; dorsal aspect of the abdomen and the tarsi with a dense pale pubescence.

*Hab.* Ceylon, Punduluoya (*Green*).

Judging by the descriptions this species appears to be smaller and redder than its allies.

### *Diplatys nigriceps* (Kirby).

*Cylindrogaster nigriceps*, Kirby, Linn. Soc. Journ. Zool., xxiii, p. 507 (1890).

Colore fuscus. Caput rotundatum, pronoto latius. Pronotum deplanatum, margine postico rotundato. Elytra et alae perfecte explicatæ, longæ, illa apice oblique rotundata. Pedes fusci, tibiis pallidioribus. Abdomen gracile, segmento ultimo magno.

♂. Abdomen medio paullo constrictum, forcipum crura brevia, basi subcontigua, valida, dehinc attenuata, recta, in parte apicali graciliora, inermia, apice ipso incurva, vix decussata.

♀. Abdomen cylindricum, minus gracile, forcipum crura inter

se distantia, basi validiora, dehinc attenuata, recta, inermia, apice attingentia.

Long. corporis 10 millim.; long. forcipum 1·4 millim.

Head blackish, rounded, slightly rounded between the eyes, broader than the pronotum ; eyes black, antennæ black, palpi testaceous. Pronotum blackish, flattened, hinder margin rounded. Elytra long and broad, dark brown, slightly paler in the female than in the male. Wings creamy, the coriaceous part blackish, shorter than in *D. longisetosa*. Legs, femora blackish, tibiæ paler, blackish at the base, tarsi paler. Abdomen black, the tubercles of the 3rd and 4th segments less distinct in the male than in the female ; in the male long and slender, subconstricted in the middle, the last segment large, its median sulcus very faint. Forceps black ♂, reddish ♀.

*Hab.* Hong-Kong (*Kirby, Mus. Brit.*) ; India, Bombay, (*Mus. Brit.*); Ceylon, Punduluoya (*Green*).

The pubescence and hairs of this species are arranged as in the last, but are less dense and strongly marked.

The specimens reared by Mr. Green differ slightly from the type form in colour. In the type form the pronotum is broadly bordered with white posteriorly, whereas it is uniform blackish in Mr. Green's examples. This difference, which is not enough to justify the establishment of a separate species, is the only distinction which I could find upon comparing Mr. Green's insects with Mr. Kirby's type.

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## Plates XVIII. and XIX.

[*See Explanations facing the* Plates].